TECHNICAL REPORT 2002-014

Single Integrated Air Picture (SIAP) Block 1 Issues

AUGUST 2002

SINGLE INTEGRATED AIR PICTURE (SIAP)

System Engineering

Task Force (SE TF)

1931 Jefferson Davis Highway
Crystal Mall 3, Suite 1109
Arlington, VA 22203

Report Documentation Page

Report Date	Report Type	Dates Covered (from... to)
00 Aug 2002	N/A	-

Title and Subtitle Single Integrated Air Picture (SIAP) Block 1 Issues	**Contract Number**
	Grant Number
	Program Element Number
Author(s)	**Project Number**
	Task Number
	Work Unit Number
Performing Organization Name(s) and Address(es) Single Integrated Air Picture (SIAP) System Engineering Task Force (SE TF) 1931 Jefferson Davis Highway Crystall Mall 3, Suite 1109 Arlington, VA 22203	**Performing Organization Report Number** TR 2002-014
Sponsoring/Monitoring Agency Name(s) and Address(es)	**Sponsor/Monitor's Acronym(s)**
	Sponsor/Monitor's Report Number(s)
Distribution/Availability Statement Approved for public release, distribution unlimited	
Supplementary Notes	
Abstract	
Subject Terms	
Report Classification unclassified	**Classification of this page** unclassified
Classification of Abstract unclassified	**Limitation of Abstract** UU
Number of Pages 47	

TECHNICAL REPORT 2002-014

Single Integrated Air Picture (SIAP)
Block 1 Issues

AUGUST 2002

SINGLE INTEGRATED AIR PICTURE (SIAP)

System Engineering

Task Force (SE TF)

1931 Jefferson Davis Highway
Crystal Mall 3, Suite 1109
Arlington, VA 22203

MR. STEVE KAROLY
Block 1 Manager

CAPT J. W. WILSON, USN
Technical Director

COL H. DUTCHYSHYN, USAF
Deputy System Engineer

RADM M. G. MATHIS, USN
System Engineer

GOVERNMENT RIGHTS IN DATA STATEMENT

FOREWORD

List of Contributors

The SIAP Block 1 Issues Technical Report is the result of collective efforts of members of the Block 1 Issues Development Team and the SIAP Block I Working Integrated Product Team (WIPT), who drafted the content of the report through several face-to-face meetings, teleconferences, and e-mail exchanges spanning the period from October 2001 through January 2002. The membership of these two groups varied over this time period. The following individuals contributed to the report through their participation in either live or virtual meetings:

Steve Karoly, SIAP SE TF (Block 1 Manager)

Jeff Allison (DASN/TCS)
Jon Barto (SIAP SE TF)
Ron Beard (NRL)
Anna Beard (SIAP SE TF/SPA)
Basel Brown (ESC Hanscom AFB)
Steve Burke (RDA CHENG)
CDR Chris Gregerson (USNO)
CDR Bob Dees (JLENS Project Office)
Pat Duggan (Lower Tier Project Office)
Larry Gloss (SIAP SE TF/SPA)
TSGT Craig Hayes (USAF/XOC)
Greg Hogan (JCIET)
Matt Kelly (BMDO)
Bill Keifrider (ASD/C3I)
Larry Lewis (JCIET)
Chuck Lewis (Contr/JLENS Project Office)
Tony Lindeman (Contr/PEO AMD)
Jeff Lutz (JCIET)
Don Marsh (JLENS Project Office)
LtCol McRae (SIAP SE TF)
Charlie Morris (AC2ISRC)
Greg Miller (APL)
Rick Oden (NCTSI)
John Osborn (Contr/PEO AMD)
Alan Perkins (AMCOM SED)
Steve Pick (JTAMDO)
Preston Poore (NSWC Dahlgren)
Jim Puckett (AC2ISRC)
Ted Rice (NSWC DD)
Ron Rothrock (SIAP SE TF/SPARTA)
Mark Schmid (APL)
Darrell Schultz (SIAP SE TF)
Pete Stafford (NSWC Dahlgren)
Lloyd Tetrault (SIAP SE TF/CSCI)
Connie Vickers (NCTSI)
Gary Weissman (SAF/AQIC)
Dale Whitehead, (SIAP SE TF/SPA)
Jim Wiley (PEO AMD)
Brandon Wilson (JCIET)
Dayle Wright (MARCORSYSCOM)

EXECUTIVE SUMMARY

PROBLEM

The Department of Defense does not have an established process to initiate and synchronize Joint warfighting capability upgrades *across* the Services to produce Joint warfighting capability. Since there was no process for the Single Integrated Air Picture System Engineering Task Force (SIAP SE TF) to inherit or leverage, the SIAP SE TF built a process to identify and select appropriate Integrated Air Defense System (IADS) issues. These issues determine the scope and content of the SIAP SE TF Block 1 system engineering processes and objectives.

OBJECTIVES

The SIAP Block 1 Issues Technical Report describes and documents the SIAP Block 1 Issue selection process and results. This Technical Report also serves as a vehicle for the solicitation of recommendations, suggestions, and insights from relevant subject matter experts, appropriate Service representatives and members of the larger Joint IADS and Missile Defense communities to improve the technical depth, credibility, and repeatability of the SIAP SE Block system engineering process.

APPROACH

The SIAP SE TF developed the initial issue selection criteria and circulated the criteria among the members and selected Service and agency representatives that comprised the SE Block 1 Issues Development Group. The SIAP SE TF used the following criteria to refine an initial Issues list:

1. Does this issue support any operational benefit?
2. Is this issue on at least three out of four service inputs for Top Ten Issues?
3. Is this issue TBMD-related?
4. Is this issue ID-related?

Collectively, the issues impact the following areas:

1. Dual tracks
2. TBMD performance
3. Combat Identification
4. Data sharing

FINDINGS

The Block Issues Development Group sorted the issues by operational benefit. The Block 1 issues are:

Operational Benefit: Reduce operator confusion by further reducing dual tracks.

Issue 1. Common Time Reference Standard
Issue 2. Data Registration/Gridlock
Issue 3. Track Quality
Issue 4. PPLI
Issue 5. Tracking/Track management
Issue 6. Consistency of distributed track databases

Operational Benefit: Reduce probability of fratricide and leakers by improving and using existing combat identification capabilities.

Issue 7. CID
Issue 8. IFF/SIF

Operational Benefit: Improve warfighting effectiveness by improving data sharing/networking capabilities.

Issue 9. Link-16 throughput
Issue 10. Multi-link translation/forwarding
Issue 11. Engage on Remote
Issue 12. Engagement Coordination

Operational Benefit: Improve Theater Ballistic Missile Defense performance.

Issue 13. TBM Issues

- Reporting
- Data association/correlation
- EW impact point prediction

CONCLUSIONS

The Block 1 Issues List reasonably bounds the Block 1 problem domain and serves to initiate the SIAP System Engineering Management Plan (SEMP).

TABLE OF CONTENTS

1. INTRODUCTION

The SIAP SE TF Charter of 26 October 2000 directed the SIAP SE to develop and maintain a disciplined system engineering process to develop and integrate a SIAP capability. Based on that direction, the SIAP SE TF is using an incremental block improvement strategy as an integral part of the system engineering effort needed to develop warfighting capability improvements.

To execute that tasking the Single Integrated Air Picture System Engineer (SIAP SE) chartered the Block 1 Working Integrated Product Team (WIPT) to lead the system engineering efforts necessary to develop engineering recommendations, with supporting rationale, that address the United States Joint Forces Command (USJFCOM) endorsed Block 1 issues. The Block 1 WIPT leverages existing and ongoing analyses to identify and recommend the most effective and efficient means (or "fixes") to achieve a SIAP capability that satisfies Joint Requirements Oversight Council (JROC)-validated warfighting requirements. The product of these recommendations will be combat-ready, operationally certified equipment and computer programs that enable the warfighter to build and maintain a SIAP, as well as inputs to tactics, techniques, and procedures (TTP) necessary to operate the components of the integrated system. The ultimate goal is to maximize offensive power projection by giving our combat forces decisive, highly reliable, flexible, robust integrated air and missile engagement options. We will achieve this goal by buying back engagement airspace/battlespace to exploit the full kinematical range of our weapons and by reducing the risk of fratricide.

Since there was no process for the Single Integrated Air Picture System Engineering Task Force (SIAP SE TF) to inherit or leverage, the SIAP SE TF built a process to identify and select appropriate Joint Integrated Air Defense System (JIADS) issues. These issues determine the scope and content of the SIAP SE TF Block 1 system engineering processes and objectives.

As a first step in this process, the SIAP SE TF convened a body of Service and Agency SMEs to discuss and document known JIADS performance deficiencies. This group, initially known as the Block 1 Issues Development Group, reached consensus on a list of IADS deficiencies. Candid and thoughtful discussion, strong interpersonal relationships, and mutual acknowledgement of the key JIADS areas of concern ensured the success of the Block 1 Issues Development Group.

The SIAP Block 1 Issues Technical Report describes and documents the SIAP Block 1 Issue selection process and results. This Technical Report also serves as a vehicle for the solicitation of recommendations, suggestions, and insights from relevant subject matter experts, appropriate Service representatives and members of the larger Joint IADS and Missile Defense communities to improve the technical depth, credibility, and repeatability of the SIAP SE Block system engineering process.

2. BLOCK 1 ISSUE DEVELOPMENT GROUP AND BLOCK 1 WIPT

As mandated by the SIAP SE TF charter, the Services agreed to:

> "Participate in SIAP SE-led engineering efforts to improve the performance of systems, which contribute to developing a SIAP. Assist in characterization of issues, including problem and root cause identification, determination of operational impact, and identification of temporary near-term fixes or changes in tactics, techniques, and procedures that can alleviate symptoms while a longer-term solution is engineered. Conduct engineering and system analysis/system trades for the determination of cost effective SIAP upgrades to legacy systems."

To that end, the Services were asked to participate in the Block 1 Issues Development process. Several face-to-face meetings, teleconferences, and e-mail exchanges witht eh Block 1 Issue Development Group spanning the period from October 2001 through January 2002 were held to produce the Candidate Block 1 Issues List.

Building upon the collaborative success of the Block 1 Issues Development Group and to conform to the Systems Engineering Master Plan (SEMP) construct, the SIAP SE chartered the Block 1 Working Integrated Product Team (WIPT), many of whose members were original participants of the Block 1 Issue Development Group.

The Block 1 WIPT leads the system engineering efforts to develop engineering recommendations, with supporting rationale, that address the United States Joint Forces Command (USJFCOM)-endorsed Block 1 Issues. The SIAP Block 1 WIPT is comprised of a core team, which is supported by SIAP SE TF members and Office of the Secretary of Defense (OSD), Regional Combatant Commanders, Joint Staff, and Department of Defense (DoD) Agencies (as required).

SIAP Block 1 Core Members:	Principle Advisors:
- SIAP SE TF Block 1 Lead (Chair)	- SIAP Analysis Team (SAT) [Rep]
- SIAP SE TF Block 1 Issue Leads	- SIAP Architecture WIPT [Rep]
- USA Subject Matter Experts (SMEs)	- Acquisition Roadmap Team (ART) [Rep]
- USN SMEs	
- USMC SMEs	
- USAF SMEs	
- JTAMDO Rep	
- MDA Rep	

The specific objectives of this WIPT are to:

a) Establish and maintain a collaborative system engineering team;
b) Establish, maintain, and refine the system engineering process (in accordance with the IEEE STD1220-1998-based System Engineering Master Plan (SEMP));

c) Produce decision-quality engineering recommendations for Joint Requirements Oversight Council (JROC) decisions;
d) Produce implementation-quality engineering recommendations for Program Manager decisions.

3. SELECTION PROCESS AND CRITERIA

In initiating the Block 1 objectives, the Block 1 Issues Development Group leveraged earlier work and processes of the SIAP Block 0 Team, specifically system engineering efforts from the Prioritized Improvement List (PIL) and Lessons Learned System Engineering Teams (SETs). While the Block 0 engineering efforts focused on two primary issues related to Link 16, identification and correlation, the Block 1 system engineering efforts are more comprehensive in nature and require a greater (and more frequent) degree of collaboration among the Service and agency representatives as well as a greater degree of structure, which is provided by the SEMP.

The SEMP is based on the engineering construct of IEEE Standard for Application and Management of Systems Engineering Process, IEEE Std 1220-1998. The work of the Block 1 Issues Development Group supports the requirements analysis phase of the IEEE Std 1220-1998 system engineering process. Specifically, the Block 1 Issues List and Candidate Block 1 Systems List (SIAP SE TF Technical Report 2002-006) sufficiently bound the overall systems engineering processes and objectives for the SIAP SE TF.

The following is the step-by-step description of a joint collaborative effort used to develop the candidate Block 1 Issues List.

Step 1. The Block 1 Issues Development Group first developed a short list of operational benefits or operational themes based on experience and engineering judgment. These operational benefits leveraged the Block 0 effort.

- Reduce operator confusion by further reducing the incidence of dual tracks
- Reduce probability of fratricide and leakers by improving and using existing combat identification capabilities
- Improve warfighting effectiveness by improving data sharing/networking capabilities
- Improve Theater Ballistic Missile Defense performance

Step 2. The Group then identified the Services' and Agency top "interoperability" issues. Each of the Services and the Missile Defense Agency (MDA (formerly BMDO)) provided their "Top Ten" interoperability issues. The Army provided two lists - one from the Lower Tier Project Office (Patriot) and a separate one from the Forward Area Air Defense Command and Control (FAAD C2) Program Office. The Navy also provided two lists - one from the Assistant Secretary of the Navy for Research, Development, and Acquisition Chief Engineer (ASN (RDA) CHENG)/Naval Surface Warfare Center Dahlgren Division (NSWCDD) and the other from the Navy Center for Tactical Systems

Interoperability (NCTSI). The Marine Corps Systems Command (MARCORSYSCOM) provided the Marine Corps list and the Electronic Systems Center (ESC) at Hanscom Air Force Base provided the Air Force list.

Step 3. The Service and MDA inputs were then mapped against a set of functions (e.g., time, navigation, data registration) derived from the JROC-validated 2010 Theater Air and Missile Defense (TAMD) Integrated Architecture. Because of subtle differences between inputs, this mapping helped aggregate the information and assisted in identifying the common issues among the Services and MDA.

Step 4. The aggregate issues were then mapped to the PIL For consistency, the original issue titles from the PIL were used, which were derived directly from Joint Theater and Air Missile Defense Organization's (JTAMDO's) Joint Mission Area Analysis (JMAA) study. To ensure the mapping was completed in the most comprehensive and accurate manner possible, steps 1 through 3 were executed iteratively.

Step 5. A set of subjective criteria were then developed to determine which of the PIL items should be placed on the Candidate Block 1 Issues List. The criteria reflect the operational and technical expertise of the participating members. The subjective criteria used were:

- Does this issue support any operational benefit?
- Is this issue on at least three out of four service inputs for Top Ten Issues?
- Is this issue TBMD-related?
- Is this issue ID-related?

Because some of the issues on the Service "Top Ten" Issues lists were closely coupled with other deficiencies, a few specific, narrowly-focused issues were added with the expectation that resolution will enhance capability in a cross-cutting fashion.

Step 6. After application of the criteria to each issue, the SIAP SE TF determined that:

- All documented issues directly support an operational benefit. (Criteria #1)

- The following issues are on 3 of the 4 Service "Top Ten" Issues lists (Criteria #2)
  - Improve data registration/gridlock
  - Implement common/functionally equivalent Link 16 messages (TQ, R2, etc.)
  - Increase Link 16 throughput
  - Implement common air track correlation algorithm
  - Develop and field low cost PPLI terminals on all friendly aircraft
  - Integrate Signals Intelligence (SIGINT) into Link 16

- The following issues are TBM related (Criteria #3)
  - Create and implement TBM/debris rules
  - Create and implement TBM data association/ correlation rules

- The following issues are ID related (Criteria #4)
  - Implement IFF/SIF fixes/improvements
  - Implement GPS enhanced PPLI reporting in airborne platforms

- The following issues are closely-couple issues:
  - Implement common time reference/standard
  - Implement approved TSR host algorithm; address ways to optimize message flow control to JTIDS/MIDS terminals
  - Implement Link 16 variable update rate track reporting
  - Field multi-link translation/forwarding capability

Step 7. To better explain the list in terms of operational benefit and to aggregate issues so they map into an analytic framework, the SIAP SE TF combined, reordered, and mapped the issues list to the Block 1 operational benefits as indicated below.

- Operational Benefit: Reduce operator confusion by further reducing dual tracks
  - Implement common time reference/standard
  - Improve data registration/gridlock
  - Implement GPS enhanced PPLI reporting in airborne platforms
  - Implement common/functionally equivalent Link 16 messages (TQ, R2, etc.)
  - Implement common air track correlation algorithm
  - Implement Link 16 variable update rate track reporting

- Operational Benefit: Reduce occurrence of fratricide and leakers by improving and using existing combat identification capabilities
  - Integrate Signals Intelligence (SIGINT) into Link 16
  - Implement IFF/SIF fixes/improvements
  - Develop and field low cost PPLI terminals on all friendly aircraft

- Operational Benefit: Improve warfighting effectiveness by improving data sharing/networking capabilities
  - Increase Link 16 throughput
  - Implement approved TSR host algorithm; address ways to optimize message flow control to JTIDS/MIDS terminals
  - Field multi-link translation/forwarding capability

- Operational Benefit: Improve Theater Ballistic Missile Defense performance
  - Create and implement TBM/debris rules
  - Create and implement TBM data association/ correlation rules

The above list was called the Draft Candidate Block 1 Issues List. The Block 1 Issues List is a subset of the existing PIL. Issues from the PIL that did not appear on the draft candidate Block 1 list are those items that did not appear on a majority of the Services' and MDA's lists. Issues that did not make the candidate Block 1 Issues list will not be

"lost"; they will remain on the PIL and be re-prioritized for possible inclusion in future SIAP Block efforts.

The Block 1 Issues Development Group recognized that this list is not the product of a "top-down" requirements-driven approach. When completed, the SIAP component of the TAMD Integrated Architecture will provide the inputs to future Block selection processes. In the meantime, the group used a bottom-up approach to develop the Candidate Block 1 list. By developing this list, the group defined an entry point into the system engineering process, thus allowing for a "bounding" of the problem.

Step 8. The Service and Agency SMEs then derived issue statements for each item on the Draft Candidate Block 1 Issues List. These statements characterize the issue in sufficient engineering detail to steer the analytic effort and to aid in the development of the functional and allocated baselines required by the Integrated Architecture. The Service and Agency issue statements were called the Block 1 Issues List.

OPERATIONAL BENEFIT: REDUCE OPERATOR CONFUSION BY FURTHER REDUCING DUAL TRACKS

Common Time Reference/Standard Issues

- Time Synchronization Internal to a Network Participant. Interface units that produce and use aerospace picture information may not have sufficiently tight time synchronization among their internal sub-units and subsystems.
- Time Synchronization Among Participants of a Network. All of a network's participants that contribute time stamped sensor or other spatial data for the aerospace picture, or that use this data may not be adequately time synchronized.
- Time Synchronization Between Data Networks. Networks that share time stamped sensor or other spatial data, via gateways (including data forwarders), may not be adequately time synchronized.
- Latency of Data Not Having Time Stamps. For sensor and other spatial data pertinent to the aerospace picture that is transmitted without a time stamp (e.g., J3.2 Air Track message), there are time latencies from when the data was last predicted prior to transmission, until the data is receipt time stamped by the network subscriber. The confidence and accuracy of the kinematic and positional data may degrade as a result of these latencies.

Data Registration Issues

- Geodetic Navigation Errors of Sensor and IU Platforms. Units contributing sensor or other spatial data for the creation and maintenance of the aerospace picture and units participating in network-based relative navigation processes may have position, velocity, and body attitude navigation errors relative to the WGS-84 geodetic frame that are preventing achievement of a SIAP.
- Inadequate Geodetic Registration of Sensor Data. Units contributing sensor data for the creation and maintenance of the aerospace picture may not be adequately correcting for sensor biases relative to the WGS-84 geodetic coordinate frame.
- Insufficient Remote IU Registration. Units may not be adequately correcting for residual data registration errors that are correctable.
- Computational Errors. Units contributing sensor or other spatial data for creation and maintenance of the aerospace picture may not properly implement accurate algorithms for all the data registration and gridlock processes and for coordinate frame translations.

TQ Issues

- The TQ algorithm, as stated in MIL-STD-6016A, is vague, non-linear, and may not be implemented correctly by all systems.
- Some systems may be reporting a TQ that does not reflect the track positional estimate accuracy.
- Inter-TADIL processing of TQ may be inadequate to support the SIAP.

PPLI Issues

- Link 16 J2.2. Air PPLI accuracies may not be optimized and may not be adequate to support sensor registration and correlation needs.
- The handling of inactive Link 16 J2.2. Air PPLIs (as documented in MIL-STD-6016A) may be causing operator confusion.

Consistency of Distributed Track Databases Issue

- Default values for the correlation variable and selectable parameters as defined in MIL-STD-6016A TM98-035 ChXX may not be optimal and may impact the probability of correct correlation (Pcc)/probability of false correlation (Pfc) that must be derived from the TAMD and CID CRDs . Also, changes in the TQ definitions (separate Block 1 issue) may impact the selection of correlation default parameters.

Tracking/Track Management Issues

- Poor tracking performance. Erratic tracks reported to the joint data network as a result of poor tracking routines, poor sensor performance or manual track actions can disrupt and degrade the aerospace picture.

- If two or more tracks cross or merge and then split, the air picture may be degraded after the event due to the inability of some trackers to accurately determine which track number should be assigned to the individual tracks. Track number(s) may change for a given object. This may lead to uncertainty with respect to whether attributes (i.e., track identification, amplifying information, track association, etc.) contained within or associated with the track number actually represent the object being tracked.

  Three critical impacts may be:
  - Improper identification of one or more friendly objects as hostile or hostile objects as friend.
  - Incorrect designation of a ballistic platform as debris, tank or RV, etc.
  - Incorrect TBM event counting as a result of failure to correctly associate tracks.

  (Note: Related factors include J2.2 Air PPLI and J2.2 Air PPLI accuracy, radar correlation/de-correlation gate sizes, algorithms, discrimination capability, radar measurement accuracy, sensor gridlock, data registration)

OPERATIONAL BENEFIT: IMPROVE THEATER BALLISTIC MISSILE DEFENSE (TBMD) PERFORMANCE

TBM Reporting Issues

- Reporting rules and criteria may be needed in MIL-STD-6016A to ensure that all participants in a theater's joint data network will be consistent in implementing the following:
  - Which objects to report;
  - Criteria associated with when and what to report;
  - Frequency with which to report air and space tracks by "Space Specific Type/Space Platform"

TBM Data Association/Correlation Issues

- There is no common standard for the association and/or correlation of objects processed and reported as space tracks. Inconsistent data association can lead to duals designations, incorrect "event counts" and otherwise degrade the situational aerospace picture.

TBM EW Impact Point Prediction Issue

- There may be a need to improve TBM Early Warning Impact Point Prediction (IPP) accuracy and to minimize confusion from redundant IPP reporting.

OPERATIONAL BENEFIT: IMPROVE WARFIGHTING EFFECTIVENESS BY IMPROVING DATA SHARING/NETWORKING CAPABILITIES

Link 16 Throughput Issue

- Inefficient use of the Link-16 bandwidth. The density of participants and data on Link-16 to support all required mission areas (e.g., subsurface, surface, air, and space) may require more bandwidth or more efficient means of using the existing bandwidth.

Multi-link Translation/Forwarding Issue

- There may be a need to reliably translate and forward information from one TADIL to another TADIL in ways that support the SIAP.

Engage on Remote (EOR) Issues

- Concepts/Capabilities for performing EOR between dissimilar weapon systems have not been fully characterized to determine the requirements (e.g., bandwidth/latency/messages) placed on the TADILS.
- There may be a need for common message standards for implementing EOR capability.
- There may be a need for common message standards for implementing sufficient data registration tolerances to support EOR capability.

OPERATIONAL BENEFIT: REDUCE PROBABILITY OF FRATRICIDE AND LEAKERS BY IMPROVING AND USING EXISTING COMBAT IDENTIFICATION CAPABILITIES

Combat Identification (CID) Issues

- Current acquisition, dissemination, and fusing of intelligence and combat ID-relevant information may be ineffective and may not enable warfighting requirements to be met for TAMD and other airspace operations.
- Cooperative ID shortfalls. Insufficient implementation of future cooperative ID capabilities on air platforms may degrade the SIAP CID situational awareness
  - All aircraft may need to be capable of transmitting J2.2 Air PPLI reports to provide state data on the transmitting aircraft and irrefutable CID data.
  - All aircraft may need to be capable of transmitting Mode 5/Mode S

IFF/SIF Issues

- There may be an inability to reliably associate and assign IFF/SIF data to air tracks.
- There may be an inability to reliably integrate IFF/SIF data within the systems.
- Some systems may not have an efficient automated mechanism or process to correct mis-associations between IFF/SIF data and radar tracks.
- There are no existing messages or protocols to support the integration of Mode 5/Mode S with Link 16.

Step 9. The SIAP SE then obtained USJFCOM and JTAMDO endorsement on the Candidate Block 1 Issue List to ensure the SIAP SE TF and Services/Agency are working on issues that are important to the warfighter. The Candidate Block 1 Issues List letter from the SIAP SE is presented in appendix B, with the response from JTAMDO and JFCOM presented as appendices C and D respectively.

4. USJFCOM AND JTAMDO-ENDORSED BLOCK 1 ISSUES

USJFCOM and JTAMDO endorsed the Block 1 operational focus of further reduction of dual tracks, improved CID, TBMD performance and data networking capabilities and the technical issues associated with each.

In addition, JTAMDO expanded on some of the lists key issues. These additions included:

Under the **Consistency of Distributed Track Databases Issue**

- To improve automatic local to remote track correlation/de-correlation, additional information such as time, track error (i.e., covariance), and altitude rate data may need to be added to the J3.2 Air Track Message. The French have gained support for a Link 16 Interface Change Proposal (ICP) for such a change, however more efficient schemes, able to compress all additional data into a single Link 16 continuation word, have been developed in the US.

Under the **Tracking/Track Management Issues**

- Sharing of sensor measurements. In order to improve tracking performance (e.g., accuracy, continuity, clarity, completeness) there may be a need to share accurately registered sensor measurements from key TAMD sensors over wideband TDLs. Fusing such measurements can improve the level of SIAP available to the warfighter.

Added the ***Engagement Coordination Issues***

- Numerous schemes have been developed to perform upper-lower tier TBMD coordination using various combinations of the J9.1, J10.2, J13.3, J2.3 and other

messages. There may be a need to reach agreement upon common implementation logic for utilizing such messages.

- There may be a need a need to develop common algorithms to provide TAMD Automated Battle Management Aids (ABMA) to the warfighter. J-Series or computer software level configuration managed messages may be used to exchange the information needed to support the ABMA functionality. ABMA may provide (1) common threat evaluation, (2) preferred shooter recommendation and (3) engagement resource allocation functionality.

Added ***OPERATIONAL BENEFIT: IMPROVE WARFIGHTER'S ABILITY TO PREDICT AND PLAN AROUND SPECIFIC UNIT TACTICAL DATA LINK (TDL) INTEROPERABILITY CAPABILITIES AND LIMITATIONS.***

Detailed database of TDL-related computer software functionality issue

- To improve our ability to predict, avoid and eliminate TDL interoperability deficiencies, an up to date detailed database of TDL-related computer software functionality may be needed. Such a database may document all TDL-related functionality differences and deficiencies. Such a database could improve the ability to make good decisions regarding which specific units should be employed in specific Joint operations.

- Establishment and updating of database. To ensure such a database is current, USD(AT&L) may need to institute a process requiring all modifications to TDL-related computer software be documented in this database. USD(AT&L) may also need to require that unintended TDL-related computer software deficiencies discovered in hardware-in-the-loop tests and live exercises be documented in this database.

- Database interoperability. For this database to be useful, it may need to be interoperable with automated TDL interoperability assessment tools such as those to be included in the emerging JICO Support System (JSS).

5. BLOCK 1 WAY AHEAD

The Joint Requirements Oversight Council tasked the SIAP SE TF to perform system engineering of current, programmed, and proposed air and missile defense systems, networks, and interfaces, as well as external supporting systems, such as global navigation, time distribution systems and Tactical Data Link (TDL) related issues.

The SIAP SE leads the Block 1 WIPT in developing candidate solutions to the Issues and in assessing the impact on IAP attributes and candidate solutions to the Issues. Representatives from the Joint Staff, the Military services, the Joint Air and Missile

Defense Organization, the Missile Defense Agency, Department of Defense Agencies, and TAMD system program offices are key and permanent contributors to the SIAP system engineering process.

The SIAP SE TF, in conjunction with the Services, focuses its system engineering efforts on a subset of the Block 1 Systems List for modeling and simulation, Hardware-in-the-loop (HWIL), and Operator-in-the-Loop (OITL) analyses. The SIAP SE TF conducts Block 1 Issues analyses as prescribed by the Integrated Assessment Plan (IAP). The SIAP SE TF uses specific Common Reference Scenario (CRS) vignette excursions for Block 1 Issue-specific analyses.

The SIAP SE TF Acquisition Branch works with cost estimates provided by the program offices to determine costs for the Block 1 systems costs appropriate cost benefit analyses of engineering recommendations. Block 1 recommendations cut across the modeled “Family of Systems”. Additionally, services may “map” benefits of like systems in order to conduct additional cost benefit analysis on systems not included in the original modeling and simulation. The costs are then compared with the impacts of the recommendations on the SIAP attributes in a cost benefit analysis. The cost benefit analysis is used to support SIAP SE recommendations to the Joint Requirements Oversight Council.

6. CONCLUSIONS

The Block 1 Issues Development Group recognized that this list is not the product of a “top-down” requirements-driven approach. When completed, the SIAP component of the TAMD Integrated Architecture will provide the inputs to future Block selection processes. In the meantime, the group used a bottom-up approach to develop the Candidate Block 1 list. By developing this list, the group defined an entry point into the system engineering process, thus allowing for a “bounding” of the problem.

Services and Agencies should provide the SIAP SE TF with comments and recommendations for improving subsequent Block “n” Candidate Issues selection criteria/process. The Block 2 WIPT will tailor the selection criteria/process, based on Service and Agency feedback for use in selecting Block 2 Candidate Issues.

As with other SIAP SE TF products, this Technical Report is a living document. The Block 1 WIPT encourages and depends upon active participation and feedback from members of the greater SIAP community.

BIBLIOGRAPHY

Theater Air Missile Defense (TAMD) Capstone Requirements Document (CRD), U.S. Joint Forces Command (Mar 01)

Joint Tactical Air Operations (JTAO) Procedural Handbook, Forces Command Fort McPherson, GA (Sep 00)

IEEE Standard for Application and Management of the Systems Engineering Process, IEEE Std 1220-1998

System Engineering Master Plan V0.8Z-4A, SIAP SE TF (2002)

*Block 1 Subject Matter Expert Statement of Wo*rk, SIAP SE TF (Feb 02; Jun 02)

Integrated Assessment Plan, SIAP SE TF (Currently the IAP is in the final SIAP SE TF signature process)

*SIAP SE Task Force Implementation Plan (*Jan 2001)

JMAA SIAP TAR SG Report (Dec 1999)

SIAP SE Task Force Charter (Oct 2000)

APPENDIX A

Services/BMDO Top Lessons Learned Interoperability Issues For SIAP

ITEM #	Interoperability Issues	SIAP Category Bugs/Struct/TTP	System Function	Root Cause Analysis Data Available	Comments
Army-01	Evaluation of the ASCIET '99 and '00 data has shown that FAAD C2 had contributed to the dual tracks, which can be pinpointed to correlation. These anomalies occurred for two main reasons: 1) different track correlation box sizes between system's (e.g. PATRIOT's) and 2) tracks not correlating due to unstable communication links. As a direct result of these findings, FAAD C2 increased the correlation gate sizes for external tracks. When the correlation logic was originally designed, stable communication links were assumed. However, recent exercises have shown this to be an invalid assumption.	Structural	TC	Yes	
Army-02	MIL-STD-6016A identifies 7 (Friend, Assumed Friend, Hostile, Suspect, Neutral, Unknown and Pending). FAAD C2 maps these IDs into one of three (Friend, Hostile, Unknown) for graphical display. However, access to the JDN ID can be viewed via the ID Event History Table in the Message Menu Viewport. *{Consideration should be given to the operational impact of displaying all the seven different ID's to the Shorad gunner.}*	Bug	ID, Display	Yes	
Army-03	FAAD C2 automatically accepts IFF data (e.g., Valid Mode IV) from the JDN without re-interrogating. During ASCEIT, some "Hostile" aircraft were reported as "Friends" to the Fire Units. Analysis of ASCIET data indicated that track mis-identifications (i.e., erroneously declaring a Friend) occurred due to incorrect IFF associations with two (2) air tracks in close proximity of each other. FAAD C2 considers a Valid Mode IV, whether from a remote or local source, a true Friend (i.e., a high confidence event).	Bug	ID	Yes	
Army-04	The current design of FAAD C2 discards tracks received from JDN with the SPI bit set. Although FAAD C2 will receive the J3.2 SPI field, it will internally discard tracks requiring special processing per the FAAD C2 B5 (Software) Specification paragraph I.3.2.11.2.1.2.a.2. Note: This issue is being addressed, and will be resolved upon release of FAAD Version 5.3 (2002 timeframe).	Bug	ID	Yes	

Army-05	PATRIOT (version PDB-5) will set the exercise indicator of a track. The impact to FAAD C2 is that when FAAD C2 receives an exercise track on the JDN, it will display it internally as a Friend (true ID). If FAAD C2 assumes R2 on the track it will retransmit the exercise ID (e.g., Faker, Joker, etc.) that was received onto the JDN. Additionally, FAAD C2 will not contest exercise ID's; it will automatically accept any received exercise ID for retransmission purposes if R2 is assumed. The exercise indication and exercise ID of the track is displayed at the FAAD C2 ABMOC as supplemental track information amplifying the Friend identity	Bug	ID	Yes	
Army-06	FAAD C2 will correlate with a JDN track with a Mode II IFF except during manual correlation when the "reported" two different tracks have non-matching Mode II codes. Specifically, FAAD C2 will not allow manual correlation when a track has had two non-matching Mode II codes in TADIL-J.	Structural	TC	Yes	
Army-07	ABT Corr/Decorr ICP	Structural	TC	Yes	
Army-08	Formation Tracking/Formation Assessment	Structural		Yes	
Army-09	Joint standards for the coordination and exchange of target data suitable for engagement-on-remote	Structural	IFC	Yes	
Army-10	Consistent rules for space track (TBM) reporting and correlation in a debris environment	Structural	DT	Yes	
Army-11	Techniques to improve the bandwidth and/or efficiency of TADIL- J throughput	Structural	TS	Yes	
Army-12	More consistent and correct reporting of Track Quality for air and space tracks	Structural	DT	Yes	
Army-13	Improved gridlock and/or self registration to support Engagement on Remote	Structural	DR	Yes	
Army-14	Link 16 ID Difference Indicator is not properly implemented in AEGIS, E-2C, PATRIOT and E-3 (and possibly other systems) [SIAP WF Shortfall 00-027]	Structural	TC	Yes	
Army-15	AWACS sometimes does not relinquish R2 of a track to a JU reporting a higher TQ [SIAP WF Shortfall 00-020]	Structural	TC	Yes	
Army-16	Rules for joint service TBM engagement coordination to include lower tier-lower tier and upper tier-upper tier	TTP	Nav	Yes	
Army-17	Improve consistency and correctness of reporting by aerial surveillance sensors (e.g., TQ, raid size, height source, position)	Structural/Bug	DT	Yes	
Army-18	Patriot sometimes reverts track ID to pending upon assuming R2 and ignores future ID difference or CDO on that track	Structural	ID	Yes	

Army-19	AEGIS does not terminate all engagements it has reported on the data link {SIAP WF Shortfall 00-016}	Structural	TC	Yes	
Army-20	Lower-Tier - SHORAD Situational Awareness that provides sufficient information to assist with engagement coordination (e.g., J10.2)	TTP	ID	Yes	
NAVY-01	Improve Joint training	TTP	ALL	No	
NAVY-02	Correct system deficiencies	Structural/Bug	ID, DT, DR, TC	Yes	See Navy sub-categories at enclosure 1
NAVY-03	Improve airborne sensors	Structural	ALL	Yes	
NAVY-04	Provide positive ID on friendly A/C (PPLI, Saber, Mode 5, etc.)	Structural	ID	Yes	
NAVY-05	Increase bandwidth/enhance B/W utilization	Structural	DT, Conn	Yes	
NAVY-06	Improve Joint SOP (CJCSM 6120/JMTOP)	TTP	ALL	N/A	
NAVY-07	Provide robust relay capability	Structural	Conn	No	
NAVY-08	Enhance JTIDS Network Library (JNL) Quality/Configuration Control	TTP	Conn	No	
AF-01	TQ discrepancies	Structural	TC, NAV, DR, DT, Conn	Yes	
AF-02	Data registration	Structural	TC, NAV, DR, DT, Conn	Yes	
AF-03	Correlation/decorrelation	Structural	TC, Conn	Yes	
AF-04	Common time standard	Structural	TS, NAV, DT, TC, Conn	Yes	
AF-05	MIL STD 6016 implementation discrepancies	Structural	ALL	Yes	
AF-06	Enable all platforms to use terminal throughput options	Structural	Conn	Yes	
AF-07	Implement TSR on all surveillance sensors	Structural	Conn	Yes	
AF-08	Promote fielding of JRE	Structural	Conn	Yes	
AF-09	Implement contention access for fighters	Structural	Conn	Yes	
AF-10	Develop & implement enhanced throughput	Structural	Conn	Yes	
AF-11	Improved tracking for low flyers (CM)	Structural	TC, DT, IFC	Yes	
AF-12	SIAP in coalition environment	Structural/TTP	ALL	Yes	
AF-13	SIAP in support of offensive missions (air dominance)	Structural/TTP	ID	No	
AF-14	Generation & exploitation of SIAP in coalition environment (e.g., Korea)	Structural	ALL	Yes	
AF-15	Relationship between SIAP and offensive air operations	Structural		Yes	
AF-16	SIGNIT asset integration improvements	Structural	CID, Conn	Yes	
AF-17	Undertake comprehensive Link 16 network design study to maximize Link 16 support to JTAMD operations	Structural	Conn	Yes	

AF-18	Develop family of datalink-to-datalink gateways	Structural	Conn	Yes	
AF-19	Combine NPG 7 & 8	Structural	Conn	Yes	
AF-20	Explore new continuation word for J3.2 providing time stamp and covariance data	Structural	DT, DR, IFC, Conn	Yes	
AF-21	Allow variable update reporting (VUR) on the JDN	Structural	Conn	Yes	
AF-22	Allow multiple reporters on the JDN (e.g., relax R2 rules during maneuvers)	Structural	DT, DR, IFC, Conn	Yes	
AF-23	Develop low-cost PPLI terminals for non-link 16 Blue aircraft	Structural	DT, Nav, DR, Conn	Yes	
USMC-01	Sensor registration and lack of clock synchronization: Especially w/r TPS-59 north finding and requirement for manual entry of radar location in TAOM. Leads to track suppression and dualing.	Structural/Bug	NAV, TS, DR	Yes	
USMC-02	Track error caused by Latency (both compensated and uncompensated)within operational facilities	Structural/Bug	DT	Yes	
USMC-03	Unreliable PPLI's (Translation of some aircraft 100's of km owing to faulty integration of nav system with terminal and latency). PPLI's for ships can also move erratically (gyro drift) in which case entire air picture shifts with the PPLI.	Structural/Bug	NAV, DR, DT, TC	Yes	
USMC-04	Significantly Different correlation rule sets between operational facilities. Leads to track suppression and dualing.	Structural	TC	Yes	
USMC-05	Lack of time tag and height rate in air track messages. Inhibits correlation accuracy during interupdate period	Structural	TC	Yes	
USMC-06	J3.2 TQ calculation inconsistency at different units, especially with arbitrary TQ assigned instead of derived from actual tracker performance estimates.	Structural	TC	Yes	
USMC-07	Inconsistent definition between J3.2 TQ and PPLI GPQ values, and unhelpful dynamic range: the tabular values for air track TQ are not pegged to meaningful operational values.	Structural	DT, TC	Yes	
USMC-08	Inflexible time slot allocation (fix is TSR or DNS)	Structural	DT, Conn, IFC	Yes	
USMC-09	Inefficient bandwidth use tied to RRN values (update rates). For example, land PPLIs, surveillance J3.2 set at 8-20 seconds, status message updates, etc.	Structural	DT, TC	Yes	
USMC-10	Doctrinal ID shortfalls (for example, ships and aircraft become TBMs if they happen to fly in a particular airspace, friendly interceptors interpreted as hostile TBMs)	Structural	ID	Yes	
USMC-11	Lack of net-wide ID definitions (inconsistent ID taxonomies)	Structural	ID	Yes	

BMDO-01	Drop Track Messages Not Transmitted for LP and IP. AEGIS: LP/IP are transmitted on the data link long after impact.	Structural	DT	Yes	
BMDO-02	AEGIS Drop Track Reports. AEGIS: AEGIS incorrectly transmits Drop Track reports for tracks which it does not have R2.	Structural/Bug	DT	Yes	
BMDO-03	CMC/EMT Does Not Perform Space track R2: CRC: The CRC Expert Missile Tracker (EMT) does not perform R2 iaw MIL-STD 6016. It is in broadcast mode only and, therefore, always assumes R2.	Bug	DT, TC	Yes	
BMDO-04	Debris Tracking. All: Several units reported numerous drbris tracks which clutter the JDN picture.	Structural	DT, Conn, TC, IFC	Yes	
BMDO-05	TBM Lost Tracks are reported after splash. AEGIS: USS LAKE ERIE continued to send Lost Tracks on Track Number 5031 after splash had occurred.	Bug	DT	Yes	
BMDO-06-A	MIL-STD 6016 provides no guidance for TBM correlation.	Structural	DT, TC	Yes	
BMDO-06-B	PATRIOT only performs local-to-remote correlation once. PATRIOT: The PATRIOT PDB-4 computer program will only perform local-to-remote correlation for a given local track once, which in some situations results in a dual designation.	Structural	DT, TC	Yes	
BMDO-07	TAOC can process and display only a limited number of PU's and JTIDs Units (JU's). TAOC: This is a significant problem for the TAOC. With the planned increase in the number of JU's in any theater of war, or exercise, without fixing this problem the TAOC will not be able to handle a majority of datalink management of BMC4I functions.	Structural	NA	Yes	
BMDO-08	JTAGS-Related Dual Tracks. JTAGS: JTAGS ability to correlate and implement R2 was not fully demonstrated during HWILT 00a.	Structural	TC	Yes	
BMDO-09	JTAGS J10.2 and J3.0 Implementation. JTAGS: JTAGS does not use the J10.2 and Drop Track It generated J3.0 and J3.6 data for nonexistent tracks, as if there was early burnout.	Structural	DT, IFC	Yes	
BMDO-10	JTAGS TBM ID Incorrect. JTAGS: JTAGS classifies TBMs by type but reports them as unknowns in TADIL-J J3.6 messages throughout their trajectory.	Structural/TTP	TC	Yes	
BMDO-11	JTAGS Correlation Capability. JTAGS: During HWILT testing, JTAGS did not appear to attempt to correlate their track with existing tracks before initiating a new track on the link	Structural/Bug	TC	Yes	

RS99/00-03	JTIDS training was needed for units arriving to their respective field locations.	TTP	Conn	Yes	
RS99/00-04	There were two primary methods for managing air track production in a Joint Integrated Air Defense System (JIADS): Track Production Areas (TPA) and Mutual Support. Both methods have benefits and limitations that must be understood so that training and planning can insure successful implementation.	Structural/TTP	DT, TC	No	
WCSL-019	PATRIOT sometimes reverts track ID to pending upon assuming R2 and ignores future ID difference or CDO on that track.	Structural/Bug	ID	Yes	
WCSL-028	Incorrect response to Command orders (machine receipts)	Bug	Display	Yes	
WCSL-032	PATRIOT improperly transmits CANTPROs	Bug	Display	Yes	

APPENDIX B

DEPARTMENT OF DEFENSE
SINGLE INTEGRATED AIR PICTURE
SYSTEM ENGINEERING TASK FORCE
1931 JEFFERSON DAVIS HIGHWAY
CM3 SUITE 1142
ARLINGTON VA 22202-3523

IN REPLY REFER TO

9800
Ser SIAP/072
2 NOV 01

From: Single Integrated Air Picture System Engineer
To: Commander in Chief, United States Joint Forces Command

Subj: SINGLE INTEGRATED AIR PICTURE (SIAP) CANDIDATE BLOCK 1 ISSUES

Ref: (a) SIAP SE TF Charter of 26 October 2000
(b) SIAP SE TF Implementation Plan of 18 January 2001

Encl: (1) Candidate Block 1 Issues List
(2) Candidate Block 1 Issues List Development Process

1. Summary. We request your endorsement of the operational benefits (i.e., "themes") and associated candidate technical issues we have identified for the SIAP SE Task Force's Block 1 effort. This letter provides candidate Block 1 Issues List and discusses the process by which it was developed.

2. Background. Reference (a) directed the SIAP SE to develop and maintain a disciplined system engineering process to develop and integrate a SIAP capability. Based on that direction, the SIAP SE TF is using an incremental block improvement strategy as an integral part of the system engineering effort needed to develop warfighting capability improvements.

a. The initial set of the incremental improvements was SIAP Block 0. Block 0 focused on two primary issues related to Link 16: identification and correlation. The three Interface Change Proposals (ICPs) that are at the heart of Block 0 are aimed at reducing the incidence of dual tracks and at improving the identification of the tracks that are exchanged. Additionally, the purpose of Block 0 was to help the Services adopt the tools and build the foundation for a collaborative engineering environment. The Block 0 effort initiated an approach for making system engineering decisions. As a pilot, Block 0 provided the team with many lessons from a variety of aspects including technical, programmatic, financial, and administrative.

Subj: SINGLE INTEGRATED AIR PICTURE (SIAP) CANDIATE BLOCK 1 ISSUES

b. The next set of the incremental improvements will be SIAP Block 1. Block 1 will incorporate lessons learned as a result of our Block 0 experience and will apply a tailored industry standard system engineering process to guide the Services' work. The following paragraphs describe the initial steps taken to develop the Block 1 themes and associated candidate technical issues.

3. Discussion. As stated in reference (b), "Block 1 will include a prioritized subset of JDN deficiencies determined by the Task Force and USJFCOM to provide the greatest operational benefit [subject to time and resource constraints] to the warfighter which can be implemented in the near- to mid-term." To that end, the SIAP SE TF developed a short list of "themes" based on experience and engineering judgment.

- Reduce operator confusion by further reducing the incidence of dual tracks
- Reduce probability of fratricide and leakers by improving and using existing combat identification capabilities
- Improve warfighting effectiveness by improving data sharing/networking capabilities
- Improve Theater Ballistic Missile Defense performance

Information obtained from the SIAP Lessons Learned System Engineering Team (SET) and experience/engineering judgment were the two primary inputs in the development of the Candidate Block 1 Issues List. Enclosure (1) provides the results of the process, described in enclosure (2), taken to develop the Candidate Block 1 Issues List.

4. Requested Action. I ask that you review and endorse enclosure (1) to ensure we are focused on valid operational "themes" and technical issues for Block 1.

5. The point of contact for this effort is Mr. Steve J. Karoly, who can be reached at (703) 602-6441 X204 or by e-mail at karolysj@navsea.navy.mil.

M. G. MATHIS

Subj: SINGLE INTEGRATED AIR PICTURE (SIAP) CANDIATE BLOCK 1 ISSUES

Distribution:
PEO AMD (Dr. Shelba Profitt (Acting), Mr. T. Cosby)
DASN TCS (Mr. Dave Altwegg)
ASN RDA CHENG (Mr. Mike O'Driscoll)
MARCORSYSCOM (Maj Mades)
SAF AQI (BGen Obering, Mr. Topolski)
BMDO (Mr. Ritter, Mr. John Flynn)
JCS (J6, J8, J38)
JCIET
DISA JIEO
JITC
AT&L (I, S&TS)
ASD C3I
ASA (ALT) (SM)
PEO C3S
OPNAV (N61, N71, N76)
NAVSEA (00)
NAVAIR (00)
SPAWAR
PEO TSC
PEO TACAIR
SPAWAR
NCTSI
NSWCDD
NWASTA
MCTSSA
ESC/DIV
ESC/CX
AC2ISRC
IDA
CNA
MITRE Bedford

26 Oct 2001

CANDIDATE BLOCK 1 ISSUES LIST

Note: This product was derived from a series of working sessions comprised of Service Subject Matter Experts (SMEs), whose inputs were consolidated and adjudicated.

Operational Benefit: Reduce operator confusion by further reducing dual tracks

Common Time Reference/Standard Issues

- Time Synchronization Internal to a Network Participant. Interface units that produce and use aerospace picture information may not have sufficiently tight time synchronization among their internal sub-units and subsystems.
- Time Synchronization Among Participants of a Network. All of a network's participants that contribute time stamped sensor or other spatial data for the aerospace picture, or that use this data may not be adequately time synchronized.
- Time Synchronization Between Data Networks. Networks that share time stamped sensor or other spatial data, via gateways (including data forwarders), may not be adequately time synchronized.
- Latency of Data Not Having Time Stamps. For sensor and other spatial data pertinent to the aerospace picture that is transmitted without a time stamp (e.g., J3.2 Air Track message), there are time latencies from when the data was last predicted prior to transmission, until the data is receipt time stamped by the network subscriber. The confidence and accuracy of the kinematic and positional data may degrade as a result of these latencies.

Data Registration Issues

- Geodetic Navigation Errors of Sensor and IU Platforms. Units contributing sensor or other spatial data for the creation and maintenance of the aerospace picture and units participating in network-based relative navigation processes may have position, velocity, and body attitude navigation errors relative to the WGS-84 geodetic frame that are preventing achievement of a SIAP.
- Inadequate Geodetic Registration of Sensor Data. Units contributing sensor data for the creation and maintenance of the aerospace picture may not be adequately correcting for sensor biases relative to the WGS-84 geodetic coordinate frame.
- Insufficient Remote IU Registration. Units may not be adequately correcting for residual data registration errors that are correctable.
- Computational Errors. Units contributing sensor or other spatial data for creation and maintenance of the aerospace picture may not properly

Encl (1)

- implement accurate algorithms for all the data registration and gridlock processes and for coordinate frame translations.

TQ Issues

- The TQ algorithm, as stated in MIL-STD-6016A, is vague, non-linear, and may not be implemented correctly by all systems.
- Some systems may be reporting a TQ that does not reflect the track positional estimate accuracy.
- Inter-TADIL processing of TQ may be inadequate to support the SIAP.

PPLI Issues

- Link 16 J2.2. Air PPLI accuracies may not be optimized and may not be adequate to support sensor registration and correlation needs.
- The handling of inactive Link 16 J2.2. Air PPLIs (as documented in MIL-STD-6016A) may be causing operator confusion.

Consistency of Distributed Track Databases Issue

- Default values for the correlation variable and selectable parameters as defined in MIL-STD-6016A TM98-035 ChXX may not be optimal and may impact the probability of correct correlation (Pcc)/probability of false correlation (Pfc) that must be derived from the TAMD and CID CRDs . Also, changes in the TQ definitions (separate Block 1 candidate issue) may impact the selection of correlation default parameters.

Tracking/Track Management Issues

- Poor tracking performance. Erratic tracks reported to the joint data network as a result of poor tracking routines, poor sensor performance or manual track actions can disrupt and degrade the aerospace picture.
- If two or more tracks cross or merge and then split, the air picture may be degraded after the event due to the inability of some trackers to accurately determine which track number should be assigned to the individual tracks. Track number(s) may change for a given object. This may lead to uncertainty with respect to whether attributes (i.e., track identification, amplifying information, track association, etc.) contained within or associated with the track number actually represent the object being tracked.

  Three critical impacts may be:
  - Improper identification of one or more friendly objects as hostile or hostile objects as friend.
  - Incorrect designation of a ballistic platform as debris, tank or RV, etc.
  - Incorrect TBM event counting as a result of failure to correctly associate tracks.

26 Oct 2001

(Note: Related factors include J2.2 Air PPLI and J2.2 Air PPLI accuracy, radar correlation/de-correlation gate sizes, algorithms, discrimination capability, radar measurement accuracy, sensor gridlock, data registration)

Operational Benefit: Improve Theater Ballistic Missile Defense performance

TBM Reporting Issue

- Reporting rules and criteria may be needed in MIL-STD-6016A to ensure that all participants in a theater's joint data network will be consistent in implementing the following:
  - Which objects to report;
  - Criteria associated with when and what to report;
  - Frequency with which to report air and space tracks by "Space Specific Type/Space Platform"

TBM Data Association/Correlation Issues

- There is no common standard for the association and/or correlation of objects processed and reported as space tracks. Inconsistent data association can lead to duals designations, incorrect "event counts" and otherwise degrade the situational aerospace picture.

TBM EW Impact Point Prediction Issue

- There may be a need to improve TBM Early Warning Impact Point Prediction (IPP) accuracy and to minimize confusion from redundant IPP reporting.

Operational Benefit: Improve warfighting effectiveness by improving data sharing/networking capabilities

Link 16 Throughput Issue

- Inefficient use of the Link-16 bandwidth. The density of participants and data on Link-16 to support all required mission areas (e.g., subsurface, surface, air, and space) may require more bandwidth or more efficient means of using the existing bandwidth.

Multi-link Translation/Forwarding Issue

- There may be a need to reliably translate and forward information from one TADIL to another TADIL in ways that support the SIAP.

Engage on Remote (EOR) Issues

- Concepts/Capabilities for performing EOR between dissimilar weapon systems have not been fully characterized to determine the requirements (e.g., bandwidth/latency/messages) placed on the TADILS.

26 Oct 2001

- There may be a need for common message standards for implementing EOR capability.
- There may be a need for common message standards for implementing sufficient data registration tolerances to support EOR capability.

Operational Benefit: Reduce probability of fratricide and leakers by improving and using existing combat identification capabilities

Combat Identification Issues

- Current acquisition, dissemination, and fusing of intelligence and combat ID-relevant information may be ineffective and may not enable warfighting requirements to be met for TAMD and other airspace operations.
- Coopertive ID shortfalls. Insufficient implementation of future cooperative ID capabilities on air platforms may degrade the SIAP CID situational awareness
  - All aircraft may need to be capable of transmitting J2.2 Air PPLI reports to provide state data on the transmitting aircraft and irrefutable CID data.
  - All aircraft may need to be capable of transmitting Mode 5/Mode S

IFF/SIF Issues

- There may be an inability to reliably associate and assign IFF/SIF data to air tracks.
- There may be an inability to reliably integrate IFF/SIF data within the systems.
- Some systems may not have an efficient automated mechanism or process to correct mis-associations between IFF/SIF data and radar tracks.
- There are no existing messages or protocols to support the integration of Mode 5/Mode S with Link 16.

Candidate Block 1 Issues List Development

The following is a step-by-step description of a joint collaborative effort used to develop the candidate Block 1 Issues List.

Step 1. SIAP SE TF developed a short list of operational benefits/themes based on experience and engineering judgment.

- Reduce operator confusion by further reducing the incidence of dual tracks
- Reduce probability of fratricide and leakers by improving and using existing combat identification capabilities
- Improve warfighting effectiveness by improving data sharing/networking capabilities
- Improve Theater Ballistic Missile Defense performance

Step 2. SIAP SE TF consolidated the Services'/BMDO's top Link-16 "interoperability" issues: Army provided two top ten lists, one from the Lower Tier Project Office (Patriot) and one from FAAD C2; Navy provided two top ten lists, one from RDA CHENG/NSWCDD and one from NCTSI; MARCORSYSCOM provided the Marine Corps' top eleven issues; ESC Hanscom provided the Air Force's top twenty-one issues; and BMDO provided their top eleven issues.

Step 3. SIAP SE TF mapped the Service/BMDO inputs against a set of functions (i.e., time, navigation, data registration) derived from the 2010 TAMD Integrated Architecture. Because of subtle differences between inputs, this mapping helped us aggregate the information and assisted us in identifying the common issues among the Services/BMDO. A spreadsheet, retained by the SIAP SE TF and posted on the SIAP website, was developed to document this mapping.

Step 4. SIAP SE TF mapped the Service/BMDO inputs and the functions to the Prioritized improvement List. For consistency, we used the original issue titles from the PIL which, in turn, derived directly from the JMAA SIAP. This mapping was accomplished so we could show how all these issues fit together.

Step 5. SIAP SE TF developed subjective criteria to determine which of the items should be placed on the

Candidate Block 1 Issues List. The subjective criteria used was as follows:

- Criteria #1: Support any or all operational benefits
- Criteria #2: On the top issues list of at least three out of the four Services (including BMDO)
- Criteria #3: TBMD related (national priority)
- Criteria #4: ID related (national priority)

Note: Several issues on the Service-provided lists were determined to be closely-coupled with other tactical data link issues. These few, specific, and narrowly-focused items were added with the expectation that resolution will enhance capability in a cross-cutting fashion.

Step 6. The resultant list followed:

- From Criteria #1:
  - All issues

- From Criteria #2:
  - Improve data registration/gridlock
  - Implement common/functionally equivalent Link 16 messages (TQ, R2, etc.)
  - Increase Link 16 throughput
  - Implement common air track correlation algorithm
  - Develop and field low cost PPLI terminals on all friendly aircraft
  - Integrate Signals Intelligence (SIGINT) into Link 16

- From Criteria #3:
  - Create and implement TBM/debris rules
  - Create and implement TBM data association/ correlation rules

- From Criteria #4:
  - Implement IFF/SIF fixes/improvements
  - Implement GPS enhanced PPLI reporting in airborne platforms

- Other closely-coupled issues:
  - Implement common time reference/standard
  - Implement approved TSR host algorithm; address ways to optimize message flow control to JTIDS/MIDS terminals

- Implement Link 16 variable update rate track reporting
- Field multi-link translation/forwarding capability

Step 7. The SIAP SE TF combined, reordered, and mapped the issues list to the Block 1 operational benefits/themes to better explain the list in terms of joint warfighting benefit.

- Operational Benefit: Reduce operator confusion by further reducing dual tracks
  - Implement common time reference/standard
  - Improve data registration/gridlock
  - Implement GPS enhanced PPLI reporting in airborne platforms
  - Implement common/functionally equivalent Link 16 messages (TQ, R2, etc.)
  - Implement common air track correlation algorithm
  - Implement Link 16 variable update rate track reporting

- Operational Benefit: Reduce probability of fratricide and leakers by improving and using existing combat identification capabilities
  - Integrate Signals Intelligence (SIGINT) into Link 16
  - Implement IFF/SIF fixes/improvements
  - Develop and field low cost PPLI terminals on all friendly aircraft

- Operational Benefit: Improve warfighting effectiveness by improving data sharing/networking capabilities
  - Increase Link 16 throughput
  - Implement approved TSR host algorithm; address ways to optimize message flow control to JTIDS/MIDS terminals
  - Field multi-link translation/forwarding capability

- Operational Benefit: Improve Theater Ballistic Missile Defense performance
  - Create and implement TBM/debris rules
  - Create and implement TBM data association/ correlation rules

This was the (draft) **candidate** Block 1 list. This list was a proper subset of the existing Prioritized Improvements List. Issues from the Prioritized Improvements List that did not appear on the candidate Block 1 list are those items that did not appear on a majority of Service and BMDO lists. Issues that did make the (draft) **candidate** Block 1 list will not be "lost"; they will remain on the PIL and be re-prioritized for possible inclusion in future SIAP Block efforts.

We recognized that this list was not the product of a top-down requirements-driven approach. Concurrent efforts are underway to complete the top-down work. In the meantime, a bottom-up approach in developing the (draft) candidate Block 1 list, as depicted above, was used. By developing this list, we were able to define an entry point into the system engineering process - thus allowing us to bound the problem.

This list is not final. Issues may be added or deleted based on results from the system engineering process.

Step 8. The Services/BMDO/SIAP SE TF derived issue statements for each item on the (draft) candidate Block 1 Issues List. The statements will be used to accurately characterize the issue in sufficient engineering detail to steer the analytic effort and to aid in the development of the functional and allocated baselines required by the Integrated Architecture.

Step 9. The Services/BMDO/SIAP SE TF determined the relative complexity of the issue (easy, medium, hard) as it relates to the extent of work already accomplished. This "binning" will assist the team in determining where they need to start.

- Easy: Problem quantified and/or well understood. Joint system engineering solution already developed, demonstrated and/or tested. Requires very limited or no system engineering effort.

- Medium: Problem quantified and/or well understood. Some system engineering work already accomplished. Good concept of the solution identified but requires supporting data.

- Hard: Problem not quantified. Must start at the beginning of the system engineering process to develop candidate-engineering solution(s)

Step 10. Obtain CINCUSJFCOM endorsement on the Candidate Block 1 Issues List to ensure we (SIAP SE TF and the Services) are working on issues important to the warfighter.

APPENDIX C

THE JOINT STAFF
WASHINGTON, DC

DEC 3 2001

Reply Zip Code:
20318-8000

MEMORANDUM FOR SINGLE INTEGRATED AIR PICTURE SYSTEM ENGINEER

SUBJECT: Single Integrated Air Picture (SIAP) Candidate Block 1 Issues

1. As requested, we have reviewed the operational benefits and technical issues identified in the SIAP-SE TF Block 1 effort. In general, we find the Candidate Block 1 Issue List (attached) to be consistent with broader TAMD requirements, architectures and priorities; however, we felt it necessary to comment and expand on some of the lists key issues (see blue text comments).

2. Future Updates. The recent JRP SIAP-SE update brought to light the critical need for Block 1 implementation (cost/benefit) analysis prior to POM '04 submission. Please provide JTAMDO updates on this analysis, in both March (prior to POM submission) and June 2002. These updates will support our continuing efforts in advocating the critical need and continuity of the SIAP-SE TF.

3. The JRP also identified a service desire for a prioritized SIAP improvement list. JTAMDO acknowledges that supporting analysis for this list has not been accomplished, but we recognize your organization's expertise to develop such a "working" list, as better analysis/incites become available. Request you share your views with JTAMDO when a list is developed.

4. Finally, JTAMDO echoes JFCOM recommendations for closer ties with service program managers in order to provide technical updates on the SIAP-SE efforts.

5. The point of contact for our review and effort is CDR Bryan McGrath, who can be reached at (703) 604-3362 or by e-mail at bryan.mcgrath@js.pentagon.mil.

RICK LEWIS
Brigadier General, USAF
Director, Joint Theater Air and
Missile Defense Organization

Attachment:
Single Integrated Picture Block 1 Issues List
w/Comment

cc:
Deputy Director & Technical Director

26 Oct 2001

CANDIDATE BLOCK 1 ISSUES LIST

Note: This product was derived from a series of working sessions comprised of Service Subject Matter Experts (SMEs), whose inputs were consolidated and adjudicated.

Operational Benefit: Reduce operator confusion by further reducing dual tracks

Common Time Reference/Standard Issues

- Time Synchronization Internal to a Network Participant. Interface units that produce and use aerospace picture information may not have sufficiently tight time synchronization among their internal sub-units and subsystems.
- Time Synchronization Among Participants of a Network. All of a network's participants that contribute time stamped sensor or other spatial data for the aerospace picture, or that use this data may not be adequately time synchronized.
- Time Synchronization Between Data Networks. Networks that share time stamped sensor or other spatial data, via gateways (including data forwarders), may not be adequately time synchronized.
- Latency of Data Not Having Time Stamps. For sensor and other spatial data pertinent to the aerospace picture that is transmitted without a time stamp (e.g., J3.2 Air Track message), there are time latencies from when the data was last predicted prior to transmission, until the data is receipt time stamped by the network subscriber. The confidence and accuracy of the kinematic and positional data may degrade as a result of these latencies.

Data Registration Issues

- Geodetic Navigation Errors of Sensor and IU Platforms. Units contributing sensor or other spatial data for the creation and maintenance of the aerospace picture and units participating in network-based relative navigation processes may have position, velocity, and body attitude navigation errors relative to the WGS-84 geodetic frame that are preventing achievement of a SIAP.
- Inadequate Geodetic Registration of Sensor Data. Units contributing sensor data for the creation and maintenance of the aerospace picture may not be adequately correcting for sensor biases relative to the WGS-84 geodetic coordinate frame.
- Insufficient Remote IU Registration. Units may not be adequately correcting for residual data registration errors that are correctable.
- Computational Errors. Units contributing sensor or other spatial data for creation and maintenance of the aerospace picture may not properly

Encl (1)

- implement accurate algorithms for all the data registration and gridlock processes and for coordinate frame translations.

TQ Issues

- The TQ algorithm, as stated in MIL-STD-6016A, is vague, non-linear, and may not be implemented correctly by all systems.
- Some systems may be reporting a TQ that does not reflect the track positional estimate accuracy.
- Inter-~~TADIL~~tactical data link (TDL) processing of TQ may be inadequate to support the SIAP.

PPLI Issues

- Link 16 J2.2. Air PPLI accuracies may not be optimized and may not be adequate to support sensor registration and correlation needs.
- The handling of inactive Link 16 J2.2. Air PPLIs (as documented in MIL-STD-6016A) may be causing operator confusion.

Consistency of Distributed Track Databases Issue

- Default values for the correlation variable and selectable parameters as defined in MIL-STD-6016A TM98-035 ChXX may not be optimal and may impact the probability of correct correlation (Pcc)/probability of false correlation (Pfc) that must be derived from the TAMD and CID CRDs . Also, changes in the TQ definitions (separate Block 1 candidate issue) may impact the selection of correlation default parameters.
- To improve automatic local to remote track correlation/de-correlation, additional information such as a time, track error (i.e., covariance), and altitude rate data may need to be added to the J3.2 Air Track message. The French have gained support for a Link 16 Interface Change Proposal (ICP) for such a change, however more efficient schemes, able to compress all additional data into a single Link 16 continuation word, have been developed in the US.

Tracking/Track Management Issues

- Poor tracking performance. Erratic tracks reported to the joint data network as a result of poor tracking routines, poor sensor performance or manual track actions can disrupt and degrade the aerospace picture.
- Sharing of sensor measurements. In order to improve tracking performance (e.g., accuracy, continuity, clarity, completeness) there may be a need to share accurately registered sensor measurements from key TAMD sensors over wideband TDLs. Fusing such measurements can improve the level of SIAP available to the warfighter.
- If two or more tracks cross or merge and then split, the air picture may be degraded after the event due to the inability of some trackers to accurately determine which track number should be assigned to the individual tracks. Track number(s) may change for a given object. This may lead to uncertainty with respect to whether attributes (i.e. track identification, amplifying

information, track association, etc.) contained within or associated with the track number actually represent the object being tracked.

Three critical impacts may be:

- Improper identification of one or more friendly objects as hostile or hostile objects as friend.
- Incorrect designation of a ballistic platform as debris, tank or RV, etc.
- Incorrect TBM event counting as a result of failure to correctly associate tracks.

(Note: Related factors include J2.2 Air PPLI and J2.2 Air PPLI accuracy, radar correlation/de-correlation gate sizes, algorithms, discrimination capability, radar measurement accuracy, sensor gridlock, data registration)

Operational Benefit: Improve Theater Ballistic Missile Defense performance

TBM Reporting Issue

- Reporting rules and criteria may be needed in MIL-STD-6016A to ensure that all participants in a theater's joint data network will be consistent in implementing the following:
  - Which objects to report;
  - Criteria associated with when and what to report;
  - Frequency with which to report air and space tracks by "Space Specific Type/Space Platform"

TBM Data Association/Correlation Issues

- There is no common standard for the association and/or correlation of objects processed and reported as space tracks. Inconsistent data association can lead to duals designations, incorrect "event counts" and otherwise degrade the situational aerospace picture.

TBM EW Impact Point Prediction Issue

- There may be a need to improve TBM Early Warning Impact Point Prediction (IPP) accuracy and to minimize confusion from redundant IPP reporting.

Operational Benefit: Improve warfighting effectiveness by improving data sharing/networking capabilities

Link 16 Throughput Issue

- Inefficient use of the Link-16 bandwidth. The density of participants and data on Link-16 to support all required mission areas (e.g., subsurface, surface, air, and space) may require more bandwidth or more efficient means of using the existing bandwidth.

26 Oct 2001

Multi-link Translation/Forwarding Issue

- There may be a need to reliably translate and forward information from one ~~TADIL~~ TDL to another ~~TADIL~~ TDL in ways that support the SIAP.

Engage on Remote (EOR) Issues

- Concepts/Capabilities for performing EOR between dissimilar weapon systems have not been fully characterized to determine the requirements (e.g. bandwidth/latency/messages) placed on the ~~TADILS~~TDLs.

3

- There may be a need for common computer software or common message standards for implementing EOR capability.
- There may be a need for common computer software or common message standards for implementing sufficient data registration tolerances to support EOR capability.

Engagement Coordination Issues

- Numerous schemes have been developed to perform upper-lower tier TBMD coordination using various combinations of the J9.1, J10.2, J13.3, J2.3 and other messages. There may be a need to reach agreement upon common implementation logic for utilizing such messages.
- There may be a need to develop common algorithms to provide TAMD Automated Battle Management Aids (ABMA) to the warfighter. J-Series or computer software level configuration managed messages may be use to exchange the information needed to support the ABMA functionality. ABMA may provide (1) common threat evaluation, (2) preferred shooter recommendation and (3) engagement resource allocation functionality.

Operational Benefit: Reduce probability of fratricide and leakers by improving and using existing combat identification capabilities

Combat Identification Issues

- Current acquisition, dissemination, and fusing of intelligence and combat ID-relevant information may be ineffective and may not enable warfighting requirements to be met for TAMD and other airspace operations.
- Coopertive ID shortfalls. Insufficient implementation of future cooperative ID capabilities on air platforms may degrade the SIAP CID situational awareness
  - All aircraft may need to be capable of transmitting J2.2 Air PPLI reports to provide state data on the transmitting aircraft and irrefutable CID data.
  - All aircraft may need to be capable of transmitting Mode 5/Mode S

26 Oct 2001

IFF/SIF Issues

- There may be an inability to reliably associate and assign IFF/SIF data to air tracks.
- There may be an inability to reliably integrate IFF/SIF data within the systems.
- Some systems may not have an efficient automated mechanism or process to correct mis-associations between IFF/SIF data and radar tracks.
- There are no existing messages or protocols to support the integration of Mode 5/Mode S with Link 16.

Operational Benefit: Improve Warfighter's ability to predict and plan around specific unit Tactical Data Link (TDL) interoperability capabilities and limitations

Detailed database of TDL-related computer software functionality Issue

- To improve our ability to predict, avoid and eliminate TDL interoperability deficiencies, an up to date detailed database of TDL-related computer software functionality may be needed. Such a database may document all TDL-related functionality differences and deficiencies. Such a database could improve the CINC staff's ability to make good decisions regarding which specific units should be employed in specific Joint operations.

- Establishment and updating of database. To ensure such a database is current, USD(AT&L) may need to institute a process requiring all modifications to TDL-related computer software to be document in this database. USD(AT&L) may also need to require that unintended TDL-related computer software deficiencies discovered in hardware-in-the-loop tests and live exercises be documented in this database.

- Database interoperability. For this database to be useful, it may need to be interoperable with automated TDL interoperability assessment tools such as those to be included in the emerging JICO Support System (JSS).

APPENDIX D

USJFCOM J8D fax:757-600-7605 Jan 7 02 15:29 P.01/05

DEPARTMENT OF DEFENSE
COMMANDER IN CHIEF
U.S. JOINT FORCES COMMAND
1562 MITSCHER AVENUE SUITE 200
NORFOLK, VA 23551-2488

IN REPLY REFER TO:
J01

07 January 02

MEMORANDUM FOR SINGLE INTEGRATED AIR PICTURE SYSTEM ENGINEER

Subject: Single Integrated Air Picture (SIAP) Candidate Block 1 Issues

1. Your letter of 2 November 2001 requested United States Joint Forces Command (USJFCOM) endorsement of the SIAP SE Task Force's Block 1 effort. This letter provides that endorsement and asks for additional specific action in related areas.

2. Background. USJFCOM is tasked by the DUSD (AT&L) to assist in setting SIAP SE TF operational requirements and priorities. The USJFCOM review of the candidate Block 1 issues was bounded by the JROC validated TAMD, CID and GIG CRDs; the 2010 TAMD Operational Concept; and anticipated improvement to joint warfighting capabilities. Informal review and discussions of the Block 1 list have also been conducted with JCIET, JTAMDO, and BMDO.

3. USJFCOM endorses the Block 1 operational focus on further reduction of dual tracks, improving Combat Identification (CID), TBMD performance and data networking capabilities and the technical issues associated with each.

4. Additional concerns in areas that impact and intersect the SIAP SE TF are provided below:

a. Several primary TAMD systems are non-compliant with MIL-STD-6016A. These deficiencies may negate or degrade the improved performance Block 0 and Block 1 are designed to provide joint warfighters. This includes system "bugs" that have been identified since 1999. There is no feedback method to ensure compliance.

b. There needs to be a database to track data link implementation and certification across all members of the TAMD Family of Systems (FoS). A central repository, coordinated with Service Program Managers, is needed to maintain and provide system data link capabilities to a community of users to support FoS configuration control, joint testing and JICO planning.

USJFCOM J85 FAX:757-836-7636 Jan 7 02 13:25 P.02/05

5. Request provide USJFCOM:

a. Technical assessment and recommendations of how to address the issues identified in paragraph 4 within 90 days.

b. The Block 1 list upon completion of the SIAP TF system engineering process. Timeliness of delivering warfighting capabilities is a continuing concern. With development of the Block 1 Decision Support Binder, request you include options for more timely implementation of the proposed actions.

6. We look forward to continued discussions in these areas and are devoted to working with you and your staff to do all possible to effect a SIAP for the warfighters. My POCs are COL Howard Harmatz, J85, DSN 836-7947, harmatz@jfcom.mil, and CAPT Joe Horn, J61, DSN 836-5540, hornj@jfcom.mil.

MARTIN J. MAYER
Vice Admiral, U.S. Navy
Deputy Commander in Chief

Reference:
Single Integrated Air Picture System Engineer ltr 9800 Ser SIAP/072 dtd 02 Nov 01

Copy to:
JTAMDO
PEO AMD (Dr. Shelba Profitt (Acting), Mr. T. Cosby)
DASN TCS (Mr. Dave Altwegg)
ASN RDA CHENG (Mr. Mike O'Driscoll)
MARCORSYSCOM (Maj Mades)
SAF AQI (BGen Obering, Mr. Topolski)
BMDO (Mr. Ritter, Mr. John Flynn)
JCS (J6, J8, J38)
JCIET
DISA JIEO
JITC
AT&L (I, S&TS)
ASC C3I
ASA (ALT) (SM)
PEO C3S
OPNAV (N61, N71, N76)
NAVSEA (00)
NAVAIR (00)
SPAWAR
PEO TSC
PEO TACAIR
NCTSI

Copy to: (Cont.)
NSWCDD
NWASTA
MCTSSA
ESC/DIV
ESC/CX
ACSISRC
IDA
CAN
MITRE Bedford